

The five kingdoms of living organisms

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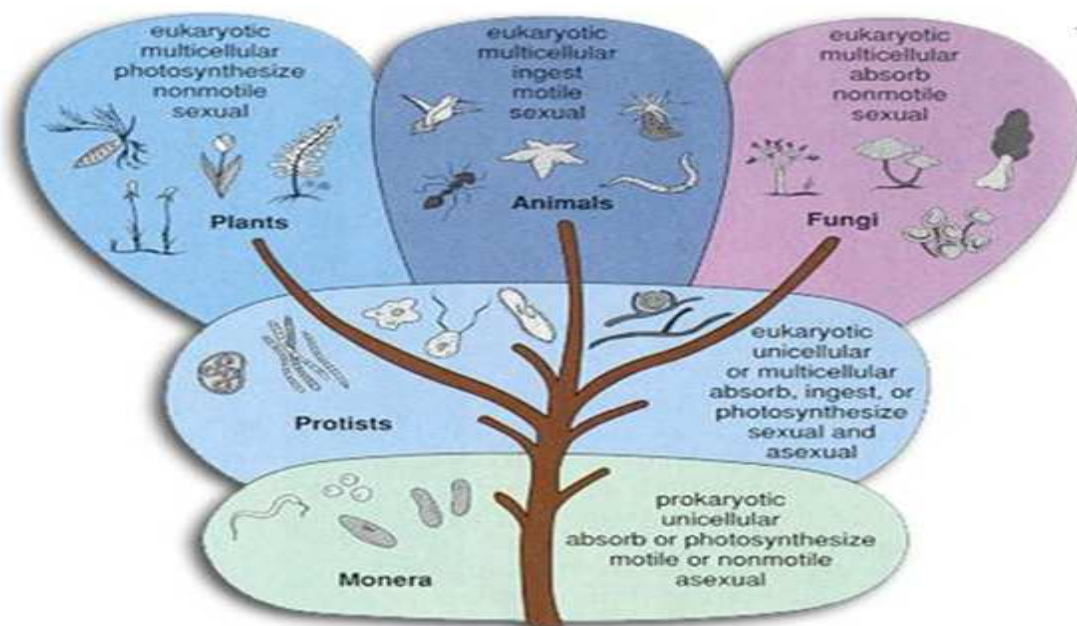
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1 The five kingdoms

The present trend in biology is to follow the five kingdom classification proposed by Robert. H. Whittaker in the year 1969. Whittaker classified the living organisms into five kingdoms namely.

1. Kingdom: Monera (prokaryotic organisms)
2. Kingdom: Protista (primitive eukaryotic organisms)
3. Kingdom: Mycota (exclusively fungi)
4. Kingdom: Metaphyta (advanced eukaryotic plants)
5. Kingdom: Metazoa (all multicellular animals)

According to this classification, Monera represent the earliest group of organisms. The Monera are thought to have given rise to Protista from which the three other kingdoms of organisms namely, the fungi, plants and animals evolved along separate lines. Fungi were the first to appear from Protista. Later, about a billion years ago some protists must have evolved into primitive multicellular animals. Still later, probably about 350 million years ago, some protists must have evolved into higher forms of plants.



1.1 Monera

The kingdom Monera includes most organisms with a prokaryotic cell organization (that is, no nucleus). For this reason, the kingdom is sometimes called Prokaryota or Prokaryotae

All organisms in the Kingdom Monera are prokaryotes. They lack nuclei and organelles and most of their cell walls are made of peptidoglycan (the exceptions are the archaeobacteria). Most utilize flagella for movement.

Digestion is extracellular (outside the cell) and nutrients are absorbed into the cell. Many prokaryotes are organized by how they metabolize resources. Autotrophs manufacture their own organic compounds. Heterotrophs obtain their energy by feeding on other organic substances. Saprophytes, a special kind of heterotroph, obtain energy by feeding on decaying matter. Some bacteria live in symbiotic relationships with other organisms. In parasitism, harm is caused to the host. In commensalism, one organism benefits while the other is unaffected. In mutualism, both organisms benefit.

Circulation and digestion in Kingdom Monera is accomplished through diffusion.

Respiration in these organisms varies. In obligate aerobes, the prokaryotes must have oxygen to live. In obligate anaerobes, the organisms cannot survive in the presence of oxygen. And in facultative anaerobes they can survive with or without oxygen.

Most organisms in the Kingdom Monera reproduce through binary fission (asexual) or conjugation (sexual).

Recently, biologists have identified two distinct groups within Monera.

The archaeobacteria have cell walls that lack peptidoglycan, cell membranes that utilize different lipids, and ribosomes similar to those found in eukaryotes.

The eubacteria ("true bacteria") are characterized by how they metabolize resources, their means of motility, and their shape. The three basic shapes are cocci (spherical), bacillus (rod shaped), and spirillum (spirals).

1.2 Protista

Protists are grouped according to whether they are animal-like, plant-like, or fungus-like.

Animal-like protists are called protozoans. They are unicellular and parasitic. Digestion in protozoans is intracellular. Circulation, respiration, and excretion are accomplished through diffusion. Most reproduce through binary fission (asexual) although some utilize conjugation (sexual).

Plant-like protists contain chlorophyll. They are both unicellular and multicellular (although multicellular forms have no organs or tissues).

- Members of Phylum Chlorophyta are the most modern and have chlorophyll a, b, and carotene.
- Members of Phylum Chrysophyta are unicellular, golden algae.
- Members of Phylum Phaeophyta are unicellular, fire algae with flagella.
- Members of Phylum Phaeophyta are multicellular, brown algae.
- Members of Phylum Rhodophyta are multicellular, red algae.
- Members of Phylum Euglenophyta live in freshwater.

Fungus-like protists are divided into three groups: myxomycota ("plasmodial slime molds"), acrasiomycota ("cellular slime molds"), and oomycetes ("mildews and water molds"). Circulation, respiration, and excretion are all accomplished through diffusion. Reproduction can be asexual through fragmentation and the production of spores or sexual through conjugation and alternation of generations

1.3 Fungi

In general, fungi are multicellular, parasitic or saprophytic, and have cell walls made of chitin. Digestion is extracellular. Rhizoids secrete enzymes and reabsorb the digested nutrients. Circulation, respiration, and excretion occur through diffusion. Reproduction can be asexual through spores or sexual where strains of fungi meet.

1.4 Plantae

In general, all plants have chlorophyll, cell walls of cellulose, and tissues and organs. Biologists have theorized that plants evolved from algae since both plants and algae have chloroplasts with chlorophyll, cell walls of cellulose, glucose stored as starch, and alternation of generations.

Plants are classified in the following divisions:

- Division Bryophyta- plants are primitive and lack vascular tissue and true roots. Examples include mosses and liverworts.
- Super Division Tracheophyta- plants are more advanced and contain vascular tissue.
- Division Pterophyta- plants reproduce by spores and grow from underground stems. Example include ferns and horsetails.
- Division Coniferophyta- plants produce naked seeds in cones and soft wood. Many are evergreens. Examples include redwoods, pines, cypress, and junipers.
- Division Anthophyta- plants are the most advanced and produce flowers. Class monocotyledonae plants have seeds that contain one cotyledon, leaves with parallel veins, flower parts in multiples of three, no cambium, and scattered vascular bundles in the stem. Class dicotyledonae plants have seeds that contain two cotyledons, leaves with netted veins, flower parts in multiples of four and five, cambium, and vascular bundles in a cylinder.

1.5 Animalia

Animals are heterotrophic, multicellular organisms with organs or tissues. Most are mobile or have a mobile life stage. All have a larval or embryonic stage of development.

Animals also exhibit different kinds of symmetry: asymmetry, spherical, radial, and bilateral.

Finally, animals can be invertebrates (no backbone) or vertebrates (with backbone).

There are more than one million species of animals, more species than all the other kingdoms combined; more than half of all animal species are insects (800,000 species), and beetles (300,000 species) comprise the largest order of insects (one fifth of all species based on a total of 1.5 million); if all the species of plants and animals on earth were lined up at random, every 5th species would be a beetle.

2 The kingdoms today

Research in the 21st century does not support the classification of the eukaryotes into *any* of the standard systems. As of April 2010, the situation appears to be that there is no set of kingdoms sufficiently supported by current research to gain widespread acceptance; as Roger & Simpson say: "with the current pace of change in our understanding of the eukaryote tree of life, we should proceed with caution."¹

¹Roger & Simpson: 2009

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